Chapter 1

Executive Summary

THIS IS THE twenty-fourth annual report documenting air pollution trends in the United States.[1–23] While in recent years this report has widened its scope to include air pollution topics such as acid rain, visibility, and air toxics, its focus remains on those pollutants for which the United States Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS). The Clean Air Act (CAA) requires EPA to periodically review and, if appropriate, revise ambient air quality standards to protect public health and welfare. Primary standards are designed to protect public health, including sensitive populations such as children and the elderly, while secondary standards protect public welfare, such as the effects of air pollution on vegetation, materials, and visibility. There are six criteria pollutants with primary standards: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM), and sulfur dioxide (SO_2).

In July 1997, EPA revised the ozone and particulate matter standards following a lengthy scientific review process. Prior to this time, the PM standard applied to particles whose aerodynamic size is less than or equal to 10 micrometers, or PM_{10}. The NAAQS revision strengthened protection against particles in the smaller part of that range by adding an indicator for $PM_{2.5}$ (those whose aerodynamic size is less than or equal to 2.5 micrometers). The combination of the PM_{10} and $PM_{2.5}$ indicators will provide protection against a wide array of particles.

Since this report deals with data for and prior to 1996, the trend data for ozone and PM_{10} are compared to the pre-existing NAAQS. However, the new standards for both ozone and particulate matter are discussed in detail in special sections in Chapter 2.

Overview and Highlights

The criteria pollutant analyses emphasized in Chapter 2 focus on national trends in air quality concentrations and emissions for the criteria pollutants. Air quality concentrations are based on actual direct measurements of pollutant concentrations in the air at selected monitoring sites across the country. Emissions are calculated estimates of the total tonnage of these pollutants, or their precursors, released into the air annually. Emissions estimates are derived from many factors, including the level of industrial activity, technology changes, fuel consumption, vehicle miles traveled (VMT), and other activities that affect air pollution. In 1994, EPA began incorporating direct emissions measurements of sulfur dioxide and nitrogen oxides (NO_x) for the electric utility industry. Additional emissions information is contained in the companion report, *National Air Pollutant Emission Trends, 1900–1996*.[24]

Table 1-1 summarizes the 10-year percent changes in national air quality concentrations and emissions.

Table 1-1. Percent Change in National Air Quality Concentrations and Emissions, 1987–1996

	Air Quality Concentration % Change 1987–1996	Emissions % Change 1987–1996
Carbon Monoxide	-37%	-18%
Lead	-75%	-50%
Nitrogen Dioxide	-10%	+3% (NO_x)
Ozone	-15%	-18% (VOC)
PM_{10}*	-25%	-12%+
Sulfur Dioxide	-37%	-14%

*Based on 1988 to 1996 data.
+Includes only directly emitted particles. Secondary PM formed from SOx, NOx, and other gases comprise a significant fraction of ambient PM.

The above table shows that air quality has continued to improve during the past 10 years for all six pollutants. Nationally, the 1996 air quality levels are the best on record for all six criteria pollutants. In fact, all the years in the 1990s have had better air quality than all the years in the 1980s, showing a steady trend of improvement.

Emissions of all criteria pollutants have improved as well, with the exception of NO_x. In October 1997, EPA proposed a rule that will significantly reduce regional emissions of NO_x and, in turn, reduce the regional transport of ozone. This rule is discussed further in the Ozone section of Chapter 2.

Chapter 3 presents trends in visibility for 29 national parks and wilderness areas in the Interagency Monitoring of PROtected Environments (IMPROVE) visibility monitoring network. Data collected at these areas show that vis-

ibility, in the form of average aerosol light extinction, has improved 10 percent in the eastern United States and 20 percent in the western United States between 1988 and 1995. When the haziest days are considered, however, visibility worsened in the East and improved in the West. Specifically, aerosol light extinction for the haziest visibility days worsened in the East by 6 percent but improved in the West by 12 percent.

Chapter 4 highlights the Photochemical Assessment Monitoring Stations (PAMS) program, which is an intensive monitoring network set up to increase our knowledge of the underlying causes of ozone pollution and potential control strategies. PAMS monitoring sites are located in all ozone nonattainment areas classified as serious, severe, or extreme. The 21 affected areas collect measurements of ozone, NO_x, and volatile organic compounds (VOCs), as well as surface and upper air meteorology. For a second consecutive year, the majority of PAMS sites show significant reductions in key ozone precursors. However, the 1995 to 1996 reductions in benzene and other mobile-related VOC concentrations were not quite as large as those between 1994 and 1995. More detailed information on the PAMS program can be found on the Internet at http://www.epa.gov/oar/oaqps/pams.

Chapter 5 presents information on air toxics, another set of pollutants regulated under the CAA which are known to cause, or may cause, adverse health effects or ecosystem damage. The Office of Air Quality Planning and Standards' (OAQPS) National Toxics Inventory (NTI) estimates that 3.7 million tons of air toxics are released to the air annually. This is the second year EPA has reported air toxics emissions based on the NTI. Data from the Toxic Release Inventory (TRI) were used as the foundation of this inventory. The development of the NTI represents a significant improvement in characterization of air toxics because the NTI shows that mobile and area sources, which are not included in TRI, account for approximately 75 percent of hazardous air pollutant emissions. This chapter reports analyses of PAMS data indicating the usefulness of this network for assessing the toxic air quality issue.

Chapter 6 summarizes the current status of nonattainment areas, which are those areas not meeting the NAAQS for at least one of the six criteria pollutants. Under the Clean Air Act Amendments (CAAA) of 1990, there were 274 areas designated nonattainment for at least one ambient standard. As of September 1997, 158 areas are still designated nonattainment, with particulate matter having the largest number (79), and ozone the second largest number (59) of areas. Note that in future years the nonattainment area list will reflect areas not meeting the new ozone and particulate matter standards. The current nonattainment areas for each criteria pollutant are displayed on one map in this chapter, while a second map depicts ozone nonattainment areas alone, color-coded to indicate the severity of the ozone problem in each area. The condensed list of nonattainment areas as of September 1997 is presented in Table A-13. This table is also on the Internet at http://www.epa.gov/airs/nonattn.html and is updated as areas are redesignated.

Chapter 7 characterizes air quality on a more local level, using three different indicators. First, this chapter lists peak air quality concentrations for 1996 for each Metropolitan Statistical Area (MSA). Second, 10-year trends are assessed for each MSA using a statistical method to measure whether the trend is up or down significantly. The results show that 13 MSAs have a statistically significant upward trend in ambient concentrations for at least one criteria pollutant, while 217 MSAs have a statistically significant downward trend for at least one criteria pollutant. The third way in which local air quality is evaluated is by looking at the Pollutant Standards Index (PSI) in the nation's largest MSAs. The PSI analysis shows that between 1987 and 1996 the total number of "unhealthful" days decreased 51 percent in the Los Angeles basin (which includes the Los Angeles and Riverside MSAs) and 75 percent in the remaining major cities across the United States.

Finally, Appendix A provides expanded tables of the air quality concentrations and emissions data described throughout this report. Appendix B summarizes the methodology which is the basis for the trends analyses in Chapter 2, and also provides maps of the current monitoring network for each criteria pollutant.

Improvement in the Face of Economic Growth

National reductions in air quality concentrations and emissions continue to occur in the face of economic growth. Since 1970, total U.S. population increased 29 percent, vehicle miles traveled increased 121 percent, and the gross domestic product (GDP) increased 104 percent (see Figure 1-1).[25,26,27] During that same period, notable reductions in air quality concentrations and emissions took place. Aggregate criteria pollutant emissions decreased 32 percent (see Figure 1-1). When examined individually, emissions for all criteria pollutants except NO_x decreased between 1970 and 1996 (see Table 1-2), the greatest improvement being a 98-percent decrease in

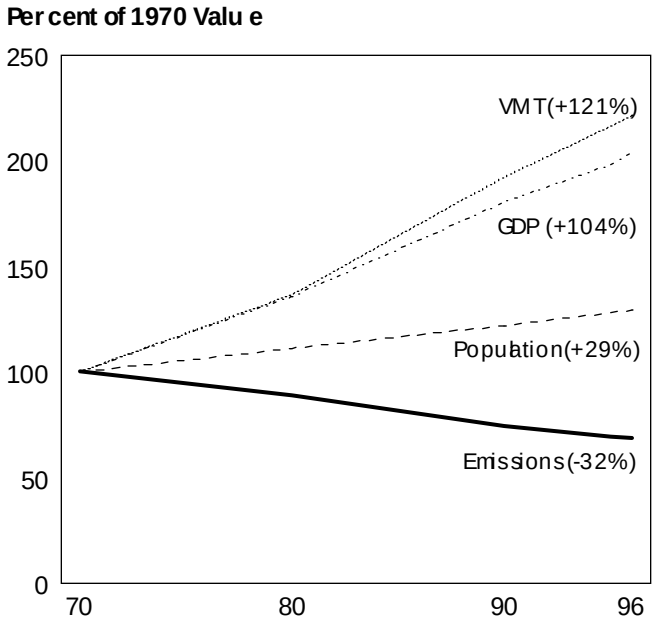

Figure 1-1. Total U.S. population, vehicle miles traveled, U.S. gross domestic product, and aggregate emissions, 1970–1996.

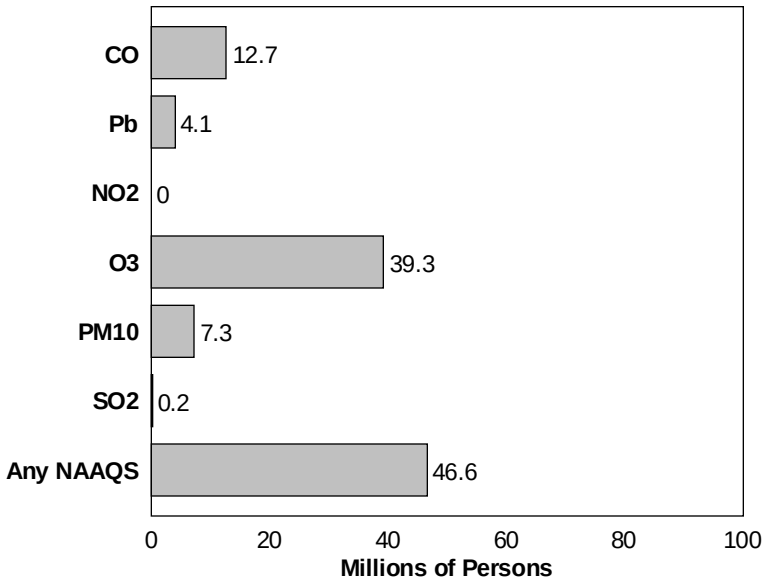

Figure 1-2. Number of people living in counties with air quality concentrations above the level of the NAAQS in 1996.

lead emissions. Though air quality trends are not available back to 1970, in most cases they are available for the past 20 years. Reductions in air quality concentrations between 1977 and 1996 are impressive with CO, lead, and SO_2 decreasing by more than half. Because of evolving monitoring networks, these long-term changes in air quality concentrations are not as certain as long-term changes in emissions, but they do provide an accurate indication of the general trend in air quality.

Table 1-2. Long-term Percent Change in National Air Quality Concentrations and Emissions

	Air Quality Concentration % Change 1977–1996	Emissions % Change 1970–1996
Carbon Monoxide	-61%	-31%
Lead	-97%	-98%
Nitrogen Dioxide	-27%	+8% (NO_x)
Ozone	-30%	-38% (VOC)
PM_{10}	Data Not Available	-73%[+]
Sulfur Dioxide	-58%	-39%

[+]Includes only directly emitted particles. Secondary PM formed from SOx, NOx, and other gases comprise a significant fraction of ambient PM.

These air quality improvements are a direct result of EPA working with states, industry, and other partners to effectively establish and implement clean air laws and regulations.

The Need for Continued Progress

While progress has been made, it is important not to lose sight of the magnitude of the air pollution problem that still remains. Based upon monitoring data submitted to EPA's data base, approximately 46 million people in the United States reside in counties that did not meet the air quality standard for at least one of the NAAQS pollutants for the single year 1996, as noted in Figure 1-2.[28,29] And in 1997, EPA re-

vised two criteria pollutant standards that were not protective enough.

After conducting one of the most extensive NAAQS reviews ever, EPA concluded that the existing standards for ozone and particulate matter were not adequately protective of public health. For ozone, several hour exposures at levels below the pre-existing standard were found to cause significant health effects, including aggravation of asthma, breathing and respiratory problems, loss of lung function, and possible long-term lung damage and lowered immunity to disease. For particulate matter, concentrations below those allowed by the previous standard were associated with significant effects including premature death, increased hospital admissions, and increaesd respiratory symptoms and disease. The scientific review concluded that additional standards should be set for fine particles, or $PM_{2.5}$. On July 16, 1997, EPA Administrator Carol Browner approved new, more protective standards for ozone and particulate matter. These standards, each year, will prevent approximately 15,000 premature deaths, 350,000 cases of aggravated asthma, and 1 million cases of significantly decreased lung function in children. EPA has developed a flexible, commonsense, and cost-effective implementation plan to achieve these standards, providing for both cleaner air and continued national economic progress. The notices and support documents for the new NAAQS are on the Internet at http://www.epa.gov/airlinks.

References

1. *The National Air Monitoring Program: Air Quality and Emissions Trends—Annual Report*, EPA-450/1-73-001a and b, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, July 1973.
2. *Monitoring and Air Quality Trends Report, 1972*, EPA-450/1-73-004, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, December 1973.
3. *Monitoring and Air Quality Trends Report, 1973*, EPA-450/1-74-007, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, October 1974.
4. *Monitoring and Air Quality Trends Report, 1974*, EPA-450/1-76-001, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, February 1976.
5. *National Air Quality and Emissions Trends Report, 1975*, EPA-450/1-76-002, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, November 1976.
6. *National Air Quality and Emissions Trends Report, 1976*, EPA-450/1-77-002, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, December 1977.
7. *National Air Quality and Emissions Trends Report, 1977*, EPA-450/2-78-052, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, December 1978.
8. *1980 Ambient Assessment—Air Portion*, EPA-450/4-81-014, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, December 1978.
9. *National Air Quality and Emissions Trends Report, 1981*, EPA-450/4-83-011, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, April 1983.
10. *National Air Quality and Emissions Trends Report, 1982*, EPA-450/4-84-002, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, March 1984.
11. *National Air Quality and Emissions Trends Report, 1983*, EPA-450/4-84-029, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, April 1985.
12. *National Air Quality and Emissions Trends Report, 1984*, EPA-450/4-86-001, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, February 1986.
13. *National Air Quality and Emissions Trends Report, 1985*, EPA-450/4-87-001, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, February 1987.
14. *National Air Quality and Emissions Trends Report, 1986*, EPA-450/4-88-001, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, February 1988.
15. *National Air Quality and Emissions Trends Report, 1987*, EPA-450/4-89-001, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, March 1989.
16. *National Air Quality and Emissions Trends Report, 1988*, EPA-450/4-90-002, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, March 1990.
17. *National Air Quality and Emissions Trends Report, 1989*, EPA-450/4-91-003, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, February 1991.

18. *National Air Quality and Emissions Trends Report, 1990*, EPA-450/4-91-023, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, November 1991.

19. *National Air Quality and Emissions Trends Report, 1991*, EPA-450/R-92-001, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, October 1992.

20. *National Air Quality and Emissions Trends Report, 1992*, EPA-454/R-93-031, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, October 1993.

21. *National Air Quality and Emissions Trends Report, 1993*, EPA-454/R-94-026, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, October 1994.

22. *National Air Quality and Emissions Trends Report, 1994*, EPA-454/R-95-014, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, October 1995.

23. *National Air Quality and Emissions Trends Report, 1995*, EPA-454/R-96-005, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, October 1996.

24. *National Air Pollutant Emission Trends, 1900–1996*, EPA-454/R-97-011, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, December 1997.

25. *Statistical Abstract of the United States, 1996*, U.S. Department of Commerce, U.S. Bureau of the Census.

26. Personal Communication with E.H. Pechan & Associates on VMT Development, Springfield, VA, August 18, 1997.

27. The Bureau of Economic Analysis, Department of Commerce, website at http://www.bea.doc.gov/bea/.

28. The population estimates in Figure 1-2 are based upon only a single year of data, 1996, and only consider counties with monitoring data for each pollutant. They are intended to provide a relative measure of the extent of the problem for each pollutant in 1996. An individual living in a county that had a measured concentration above the level the NAAQS may not actually be exposed to unhealthy air.

29. The number of people living in formally designated nonattainment areas as of September 1997 was approximately 120 million. These population estimates differ because formal nonattainment designations are based on multiple years of data rather than a single year and generally do not follow county boundaries. For a pollutant such as ozone, nonattainment areas typically compose the entire metropolitan area, which may include additional counties that do not contain monitors.